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ABSTRACT

The 13 articles in this annotated bibliography cover a wide range of concerns from the finances of energy conservation to solar energy applications, to building design, to building maintenance, and to the role of the science teacher as an energy analyst and activist. (IRT)

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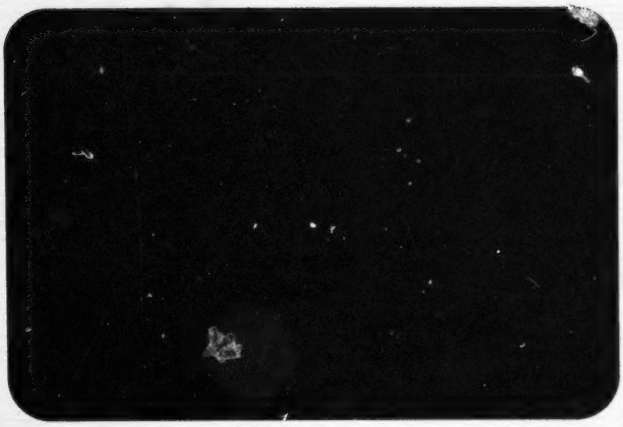

Number 19 August 1976

*The Best of ERIC* presents annotations of ERIC literature on important topics in educational management.

The selections are intended to give the practicing educator easy access to the most significant and useful information available from ERIC. Because of space limitations, the items listed should be viewed as representative, rather than exhaustive, of literature meeting those criteria.

Materials were selected for inclusion from the ERIC catalogs *Resources in Education (RIE)* and *Current Index to Journals in Education (CIJE).*

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# Energy Conservation

**Agne, Russell M.; Conrad, David; and Nash, Robert J.** "The Science Teacher As Energy Analyst and Activist." ***Science Teacher,*** 41, 8 (November 1974), pp. 12-17. EJ 106 477.

This thought-provoking article explores the role of the science teacher in leading classroom studies of energy conservation and the energy crisis. Agne, Conrad, and Nash maintain that in view of serious world energy shortages, the classroom study of energy must go beyond its physical or biological context and "contend with the important psychological-political-economic issues raised by the energy crisis."

The authors offer a number of questions and topics for discussion designed to help students explore the reasons for the energy crisis and their own contributions to it. Such questions as "What are two specific measures I have taken to reduce energy consumption?" and "Would I maintain my life style if there were not parental and/or peer pressure?" prod students into clarifying their own attitudes and values concerning energy use.

Agne, Conrad, and Nash urge that science teachers concern themselves with "the relationship of the energy issue to the day-to-day lives of people in our society." This type of approach to the teaching of energy conservation is unusual for science teachers, yet the authors make a convincing case that such an approach is necessary if today's students are to solve tomorrow's grave energy problems.

**Anderson, Calvin E.** "The Impact of the Energy Crisis on School Finance." ***Phi Delta Kappan,*** 57, 3 (November 1975), pp. 193-196. EJ 125 815.

Anderson begins this exhaustive article on the energy crisis by placing school energy use within the context of the energy problems facing the United States and the world. Noting that although the United States contains only 5.5 percent of the world's population, it consumes 30 percent of the world's energy, Anderson argues convincingly that schools, housing nearly 25 percent of the nation's population each school day, must make a concerted effort to curb energy waste.

Anderson notes, too, that "it is only a matter of time before the inflationary costs of energy will begin to eat into the quality of our educational curricula and into the teacher's paycheck."

In such a context, his list of practical suggestions for school energy savings assumes considerable importance. Each district, for example, should "initiate a comprehensive energy audit to determine patterns of energy use." Such an audit provides a basis for monthly energy cost comparisons and thus highlights areas for possible savings.

Anderson also underscores the need for a school's maintenance personnel to be skilled in the proper operation of today's complex heating, ventilating, and air conditioning (HVAC) systems. Their attention to simple energy-saving techniques (such as switching off lights and the HVAC system in each room as they finish cleaning) can result in daily power savings of 20 percent or more.

**Building Systems Information Clearinghouse.** ***Case Studies of Energy Use: Elementary and Secondary Schools. BSIC/EFL Energy Workbook No. 1.*** Menlo Park, California: 1974. 24 pages. ED 096 733.

Although short, the five studies contained in this report are especially useful because they contain actual figures (both in energy units and dollars and cents) concerning the efficacy of energy-saving methods.

In an unusual building program in Fairfax County, Virginia, the school board, instead of awarding the construction contract to the lowest bidder, set a fixed price for the new building at the outset, then used energy consumption as a major element in evaluating the proposed plans.

Each plan submitted was run through the Meriwether package of computer simulation to estimate probable energy use. A chart, containing each plan's estimated number of kilowatt hours per square foot, summarizes the results.

The report concludes that "the incorporation of energy conservation criteria into the program had no major inhibiting impact on either the design or cost of the facilities and will result in substantial energy and energy cost savings in the future."

Another report focuses on the Huntington Beach, California, system where a detailed study of energy use was made of schools of similar size that nevertheless used vastly different amounts of energy. The study, which monitored hourly energy consumption, led to the discovery that improperly set or inoperative timers on heating and ventilating systems were responsible for one school's excessive energy use during weekends

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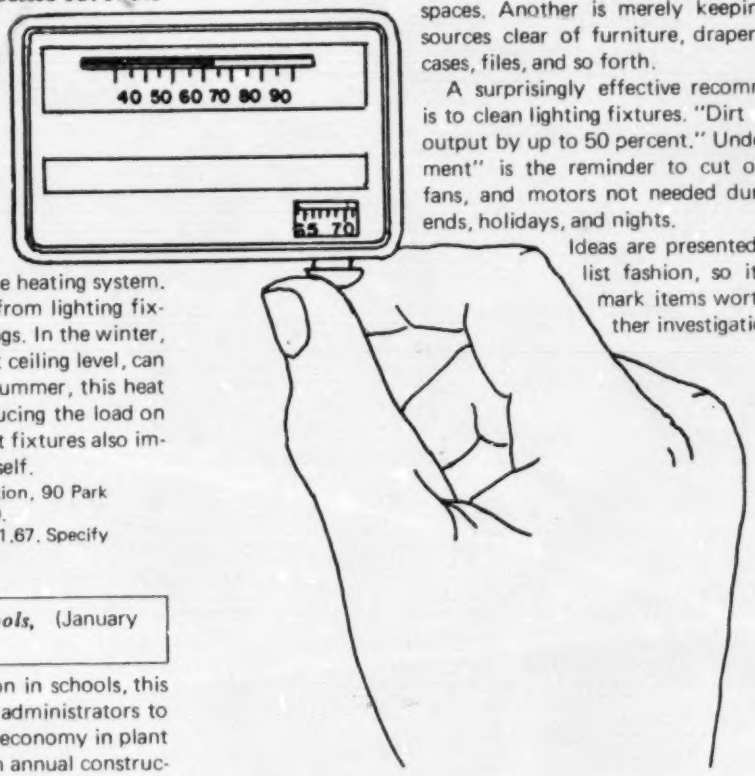
and vacations. By servicing timers, tuning machinery, and making other equipment adjustments, the school was able to save over $14,000 on gas and electricity for one year.

Building Systems Information Clearinghouse has come to some thoughtful conclusions concerning research on energy use. One is that many energy studies are "weak in direction and objectives" and that suggestions generated by these studies "have not been tested in life situations." These are telling criticisms, unfortunately applicable to many energy studies.

Order copies from Educational Facilities Laboratories, 850 Third Avenue, New York, New York 10022. $2.00. Also available from EDRS. MF $0.83 HC $1.67. Specify ED number.

Electric Energy Association. ***Cost and Energy Savings Opportunities with Heating, Air Conditioning and Lighting Systems in Schools.*** New York: 1973. 12 pages. ED 083 674.

Besides the usual checklist of ways to conserve energy, this article contains a concise and easy-to-understand explanation of heating, ventilating, air conditioning, and lighting systems that recover and reuse heat usually wasted. These systems utilize heat given off by light fixtures and heat passed out of the building through ventilator exhaust.




"The ventilation requirements of schools can be responsible for substantial energy losses," maintains the article. "Air that has been heated or cooled, then exhausted to the outdoors, must be replaced by outside air which in turn has to be heated or cooled to bring it to proper temperature and humidity." Four different heat exchange systems are described, all of which absorb heat from exhaust ducts and transfer it back to the heating system.

Another system, designed to utilize heat from lighting fixtures, provides both summer and winter savings. In the winter, the light fixtures give off heat that, useless at ceiling level, can be transferred to the heating ducts. In the summer, this heat is merely vented to the outside, thereby reducing the load on the air conditioning. This cooling of the light fixtures also improves the efficiency of the lighting system itself.

Order copies from Electric Energy Association, 90 Park Avenue, New York, New York 10016. $0.60. Also available from EDRS. MF $0.83 HC $1.67. Specify ED number.

"The Energy Advisor." ***Modern Schools,*** (January 1974), p. 9. EJ 092 615.

The first in a series on energy conservation in schools, this article notes three basic reasons for school administrators to stress energy savings. The first, of course, is economy in plant operation. The second is that schools, with an annual construction budget of $5 billion, owe it to the public to turn the focus of the construction industry to energy savings. And the third is that the schools must exemplify the conservationist attitude to students.

The focus of this article is on an issue cited often when energy conservation in construction is discussed: life-cycle costing. Life-cycle costing is the calculation of how much it will cost to maintain and operate a building over its entire lifetime. Too often, when choosing new building or energy system options, administrators choose those with the least initial cost with little regard to life-cycle costing. This article maintains that "over a building's lifetime, ill-considered economies in construction cost almost always prove expensive in the long run."

An average school has a lifespan of 40 years. The costs of operating and maintaining the building over this period are actually 50 percent greater than the initial construction costs.

"Energy Crisis: What Schools Are Doing about It." ***American School and University,*** 46, 6 (February 1974), pp. 53-57. EJ 092 648.

This article, the result of a survey, offers a sensible and complete checklist for those looking for ways to conserve energy in schools. The measures are actually in use in schools, colleges, and universities throughout the country.

The list is divided into seven categories. Suggestions for administrators focus on raising awareness through such measures as inviting and publicizing energy-saving ideas and conducting training sessions about techniques to conserve energy. Under "Heating, Ventilating, and Air Conditioning," several suggestions concern maintenance and repair. A simple but effective tip is to turn heating controls down to night cycle an hour before school closes, relying on existing heat to keep the temperature at a reasonable level.

Under the buildings section, one recommendation is to insulate ducts and hot water pipes that extend through cold spaces. Another is merely keeping heating sources clear of furniture, draperies, bookcases, files, and so forth.

A surprisingly effective recommendation is to clean lighting fixtures. "Dirt can reduce output by up to 50 percent." Under "Equipment" is the reminder to cut off pumps, fans, and motors not needed during weekends, holidays, and nights.

Ideas are presented in checklist fashion, so it's easy to mark items worthy of further investigation.

ERIC Clearinghouse on Educational Management, and American Association of School Administrators. ***ERIC Abstracts: ERIC Document Resumes on Energy Conservation and the Schools. ERIC Abstract Series, Number Thirty-five.*** Eugene, Oregon; and Washington, D.C.: 1976. 18 pages. ED 120 894.

This 24-item bibliography is a compilation of documents concerning energy conservation listed in ERIC's monthly catalog, ***Resources in Education (RIE).*** Complete for all issues of ***RIE*** through September 1975, the documents deal with energy conservation and the energy crisis and their implications for public schools.

Included are practical checklists for reducing energy consumption, examinations of the efficiency of several energy systems (from traditional heating, ventilating, and air conditioning to solar cooling), and energy-saving building design tips. Abstracts of each document are included.

Order copies from American Association of School Administrators, 1801 North Moore Street, Arlington, Virginia 22209. Stock No. 021-00449, $2.00, plus $1.00 handling charge for each order. Quantity discounts, orders under $15.00 must be prepaid.
Also available from EDRS. MF $0.83 HC $1.67. Specify ED number.

**Fowler, John W.** ***Energy-Environment Source Book. Volume 1: Energy, Society, and the Environment. Volume 2: Energy, Its Extraction, Conversion and Use.*** Washington, D.C.: National Science Teachers Association, 1975. 270 pages. ED 111 662.

Fowler presents a sweeping overview of energy issues for science, humanities, and social studies teachers. One of a three-part series on energy-environment, the book examines economic, political, and societal aspects of energy use (in volume 1) as well as scientific and technical aspects (in volume 2).

Most ideas are expressed in rather sophisticated terms, making the book most useful for secondary teachers, but it also will be appreciated by elementary teachers who want to base their teaching of energy problems on a broader and deeper understanding of the issue. According to Fowler, "The message that cries out from analysis after analysis, and the response which could have the most immediate and positive impact on the widest range of problems, is a simple one. We must use less energy."

A highlight of the section on strategies for energy conservation is a chart graphically comparing the effects of such strategies designed to conserve oil as resetting thermometers three degrees lower (calculated to save the United States 450,000 barrels of oil per day) and a 50 m.p.h. speed limit (saving 3,000,000 barrels per day).

Order copies from National Science Teachers Association, 1742 Connecticut Avenue, N.W., Washington, D.C. 20009. Stock No. 471-14692, $4.00 prepaid.
Order MF from EDRS, $0.83. Specify ED number.

**Mervine, Kathryn E.,** and **Cawley, Rebecca E.** ***Energy-Environment Materials Guide.*** Washington, D.C.: National Science Teachers Association, 1975. 68 pages. ED 111 663.

Mervine and Cawley's annotated bibliography is a helpful guide through the maze of literature on energy and environmental issues. One of a three-part series on energy-environment published by the National Science Teachers Association, it contains a list of 300 books and articles divided into four categories of readings: for teachers, for students grades 8-10, for students grades 5-9, and for students grades K-6. Selections chosen are those thought to be "interesting, informative, and likely to be available in your school or public library."

Easy-to-read annotations evaluate both style and content. Appendixes include guides for films, audiovisual materials, curriculum materials, sources of information, and government documents.

Order copies from National Science Teachers Association, 1742 Connecticut Avenue, N.W., Washington, D.C. 20009. Stock No. 471-14694, $2.00 prepaid.
Order MF from EDRS, $0.83. Specify ED number.

**Ontario Department of Education.** ***Energy Conservation for Schools.*** Toronto: 1975. 26 pages. ED 120 967.

An interesting statement, "The less energy we use, the better our chance of finding new sources or additional supplies of existing sources before present supplies run out," begins this unusually complete and thoughtful booklet. To accomplish this goal, it offers a number of sound energy conservation considerations for both existing and contemplated buildings.

A detailed section on calculating long-term building costs cites important yet easily overlooked considerations. One is that in determining whether an energy-saving initial cash investment will pay for itself in the long run, interest on the initial cash investment must be considered. "Interest charges always apply, for the simple reason that borrowed money always carries a charge for its use, and unused, or saved money always carries the potential of earning interest," explains the article.

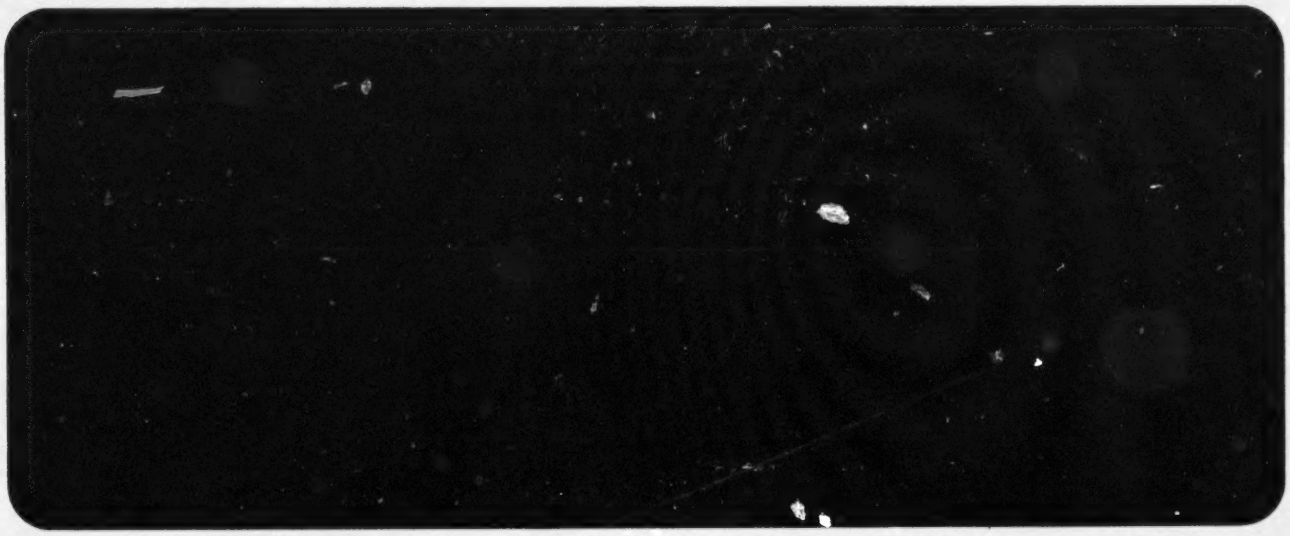
Architectural considerations that affect energy consumption are shape (especially surface area), site (including topography and trees), and orientation (east/west rather than north/south). An important design factor is minimization of floor-to-ceiling height.

An "Operation Checklist" that is short because it does not belabor the obvious contains such tips as "place lamps to give the desired illumination at task stations and reduce lighting levels in non-essential areas," and "lower storage tank temperatures of domestic hot water heating systems to the point where the storage capacity is just sufficient to meet the occupancy requirements."

Order copies from Ontario Ministry of Education, 21st Floor, Mowat Block, Queen's Park, Toronto, Canada M7A 1L2.
Also available from EDRS. MF $0.83 HC $2.06. Specify ED number.

**Stein, Richard G.,** and **Stein, Carl.** ***Low Energy Utilization School: Research, Design, Construction, and Evaluation. Phase I: Interim Report.*** New York: Richard G. Stein and Associates, Architects, 1974. 297 pages. ED 099 962.

This report, one of the most detailed and carefully researched on energy use, summarizes energy studies conducted in almost 1,000 New York City schools. One of its greatest strengths is that the report's data were obtained by actually measuring classroom energy use—a method of data gathering superior to even computer simulations or laboratory tests.



Stein and Stein contend that even carefully monitored New York City schools are using 25 to 50 percent more energy than is really necessary. If this is so, their findings can have tremendous impact on school energy use everywhere. One important discovery is that there is no dangerous change in air quality with ventilation levels less than one-third the level presently prescribed in New York City schools. The authors include useful lists of actual ventilation requirements in cubic feet per minute per person in each kind of school area.

The report, after carefully comparing lighting levels and test scores, also concludes that there is no correlation between higher light levels and educational achievement. By selectively controlling lighting levels to fit the task being undertaken, and by increased use of natural lighting, substantial electricity can be saved. The report also includes recommended amounts of lighting for various school activities.

A finding with great repercussions for school construction is that "sealed, minimum window school buildings consume considerably more energy (up to three times the average) than buildings having open window air supply possibility." Stein and Stein maintain that natural means of controlling light, temperature, and ventilation are not being used to their full potential, noting, "Mechanical systems have tended to dominate architectural design, have redundantly duplicated available natural conditions and have become overly complicated."

Order from EDRS. MF $0.83 HC $15.39. Specify ED

**Stephan, Edward.** "Energy Guidelines for Schools." ***American School and University,*** 47, 6 (February 1975), pp. 51-53. EJ 110 960.

In this article, the first in a series on energy management, Stephan describes the program used by the Educational Facilities Laboratories (EFL) and the Fairfax County, Virginia, school system to determine how Fairfax schools could conserve energy. Unlike many such attempts, this program used more than mere common-sense measures to determine effective ways of reducing fuel consumption. A detailed analysis was made of the heating, ventilating, air conditioning, electrical, and plumbing energy use in each school and fed into a computer programmed to simulate the effects of certain proposed "operational and physical changes in terms of energy consumption."

Several important findings resulted. For instance, the computer determined that one school analyzed could save an annual total of $5,949 merely by reducing the excessive amount of outside air intake to no more than necessary to comply with state standards.

The computer also analyzed the financial result of installing double glazing on all windows—a measure frequently recommended for energy conservation. In one school analyzed, it was determined that the glazing would lead to energy savings of $1,778 per year, but the modification would be so costly to initiate that it would take the school 62.4 years to break even.

This study clearly reveals that we must use more than mere intuition to predict which energy conservation measures will result in real financial savings for schools.

"Watts Happening with the Sun in Massachusetts, in Maryland, in Minnesota." ***Modern Schools,*** (September 1974), pp. 4-7. EJ 104 127.

In an unprecedented experiment in the spring of 1974, four schools began using solar energy to provide supplemental heat. The experiment, under the auspices of the National Science Foundation, is an attempt to ascertain if solar energy systems can be economical as well as socially acceptable.

The article briefly describes the systems installed in the schools (in Massachusetts, Maryland, and Minnesota). All employ unbreakable plastic panels to collect the sun's rays. "For every two square feet of building interior to be heated, the collector equipment requires about one foot of roof or ground." For the administrator who wants to assess the aesthetic implications of such a system, there are excellent pictures of installed roof and ground panel systems.

The article explains that the solar systems are designed to provide from 6 to 20 percent of the heat used by the buildings. Two systems have storage tanks to store excess heat for use on cloudy days. In the Maryland system the tank will store enough energy to heat the school for four to five days.

Although brief, this article is an excellent jumping-off point for those interested in the feasibility of installing solar heating in existing schools as an energy conservation measure.

ERIC Clearinghouse on Educational Management
University of Oregon
Eugene, Oregon 97403